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A4D 11

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GB A 2053012	GB 1235235	GB 1114440
GB 1575087	GB 1218134	GB 1091131
GB 1329361	GB 1169744	GB 0990889
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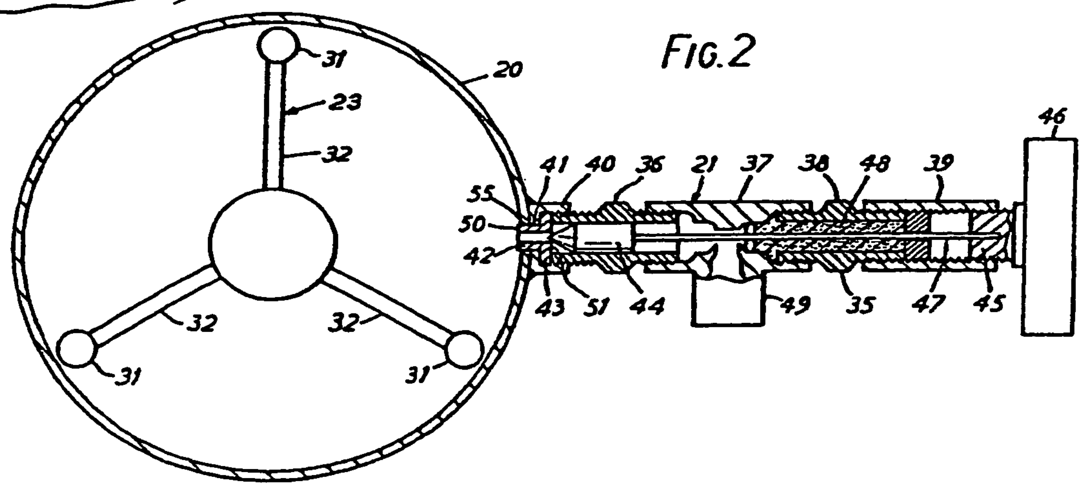
(58) Field of search
F4U
A4D
Selected US specifications from IPC sub-class A23L

(54) Heating particulate material

(57) Shredded cheese is heated by passing it continuously through an elongated chamber, injecting steam into the chamber at spaced intervals along the chamber, and mechanically stirring the cheese in the chamber while the steam is being injected. The steam is injected through nozzles made of polytetrafluoroethylene to prevent the cheese being burnt by the nozzles.

FIG. 2



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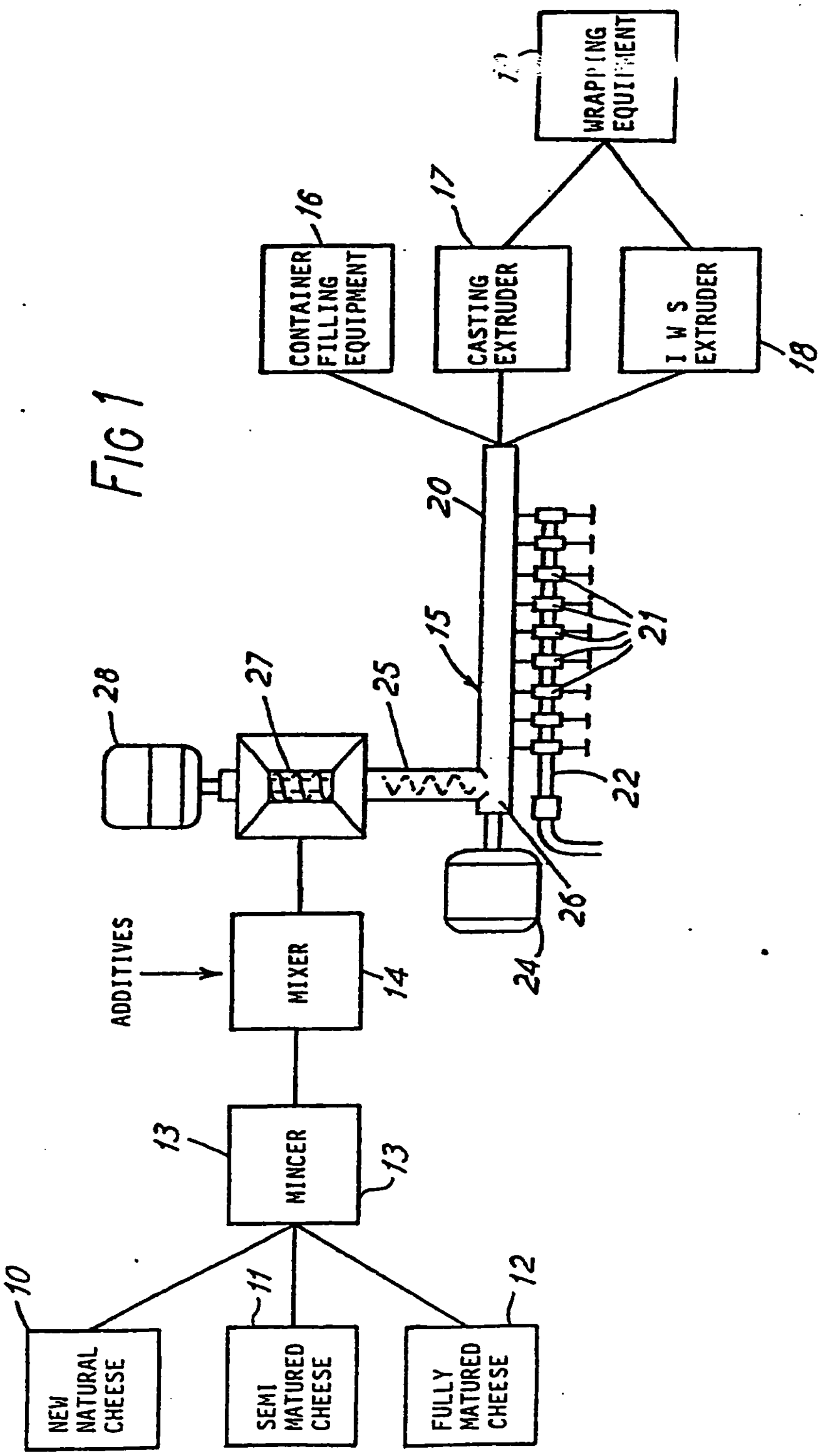
NEW NATURAL CHEESE
10
SEMI MATURED CHEESE
11
FULLY MATURED CHEESE
12
MINCER
13
13
13
ADDITIVES
MIXER
14
28
27
25
15
26
24
22
21
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CONTAINER FILLING EQUIPMENT
16
CASTING EXTRUDER
17
I W S EXTRUDER
18
WRAPPING EQUIPMENT

FIG 1

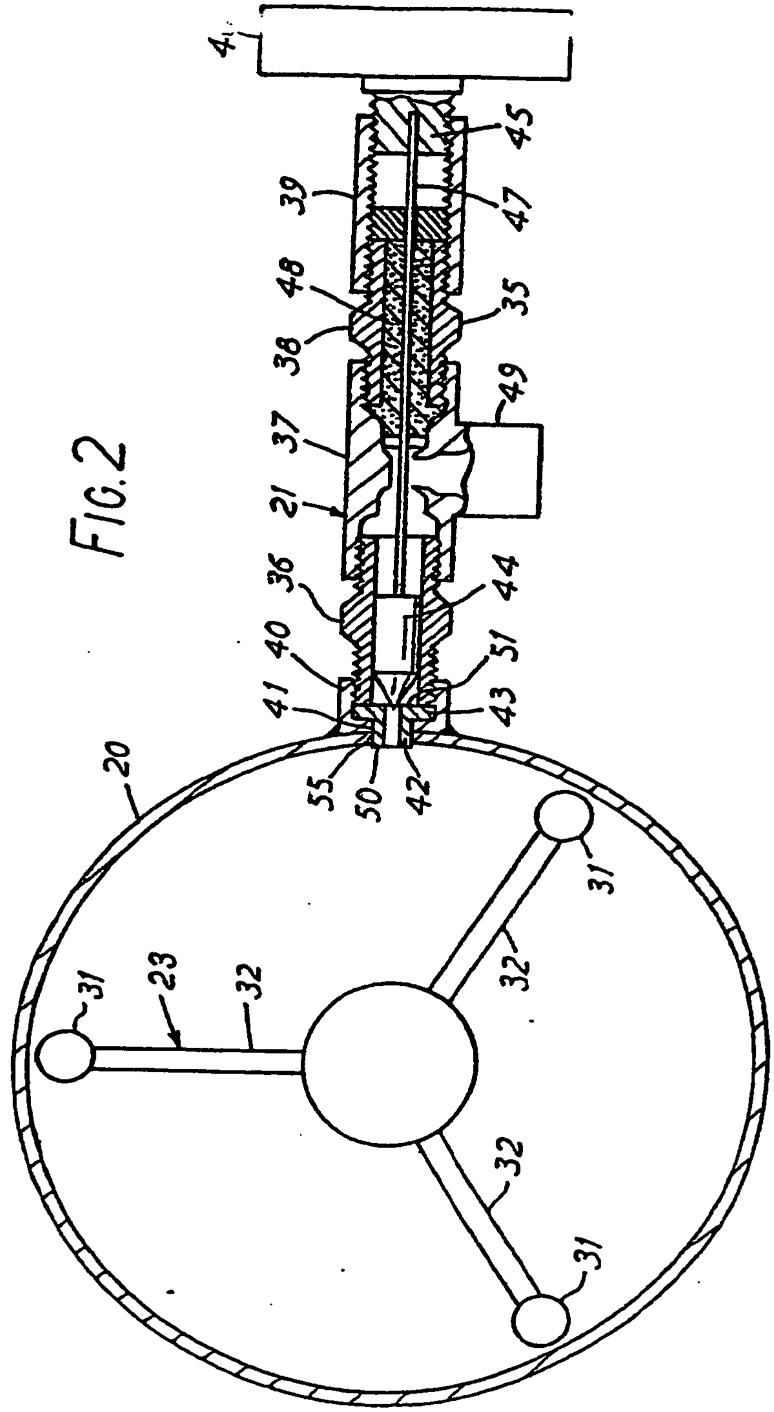
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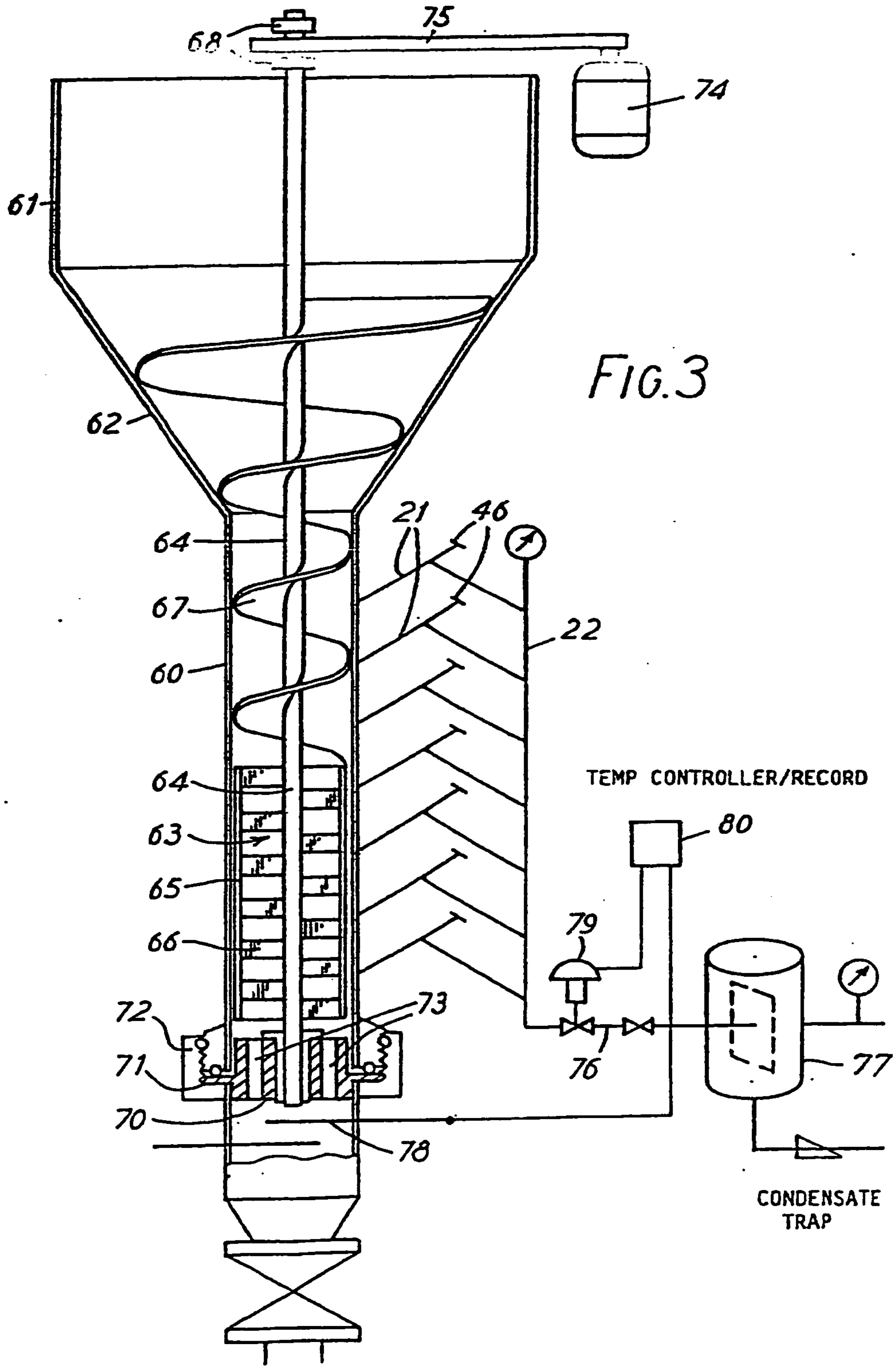
FIG. 2


68
75
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61
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67
60
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63
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66
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71
70
73
78
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22
TEMP CONTROLLER/RECORD
80
79
76
77
CONDENSATE
TRAP

FIG.3

SPECIFICATION

Method and apparatus for the heating of a granular, comminuted solid, or viscous product

This invention relates to the heating of a granular, comminuted solid, or viscous product, and is concerned more particularly but not exclusively to the heating of a food product which tends to become "burnt" when part of the product is subjected to excess heat.

The invention is however particularly applicable to the cooking of shredded cheese in the manufacture of processed cheese, and the invention will be described with reference to this application.

In the traditional method of manufacturing processed cheese, the raw cheese is shredded in a mincer and then heated in batches in a kettle or autoclave by injection of steam into the kettle. The heating chamber in the kettle is substantially spherical and the steam is injected through nozzle which project into the interior of the heating chamber, and the cheese is agitated by a power driven stirrer while the steam is being introduced into the heating chamber. The filling and emptying of the kettle for each batch of cheese is labour intensive. Also, particular care must be taken in cleaning out the nozzles since, when steam is cut off at the end of the cooking operation, the steam remaining in the nozzles condenses and creates a vacuum which draws cooked curd into the nozzles. When the steam is turned on again in the next cooking operation, the steam tends to burn any cheese inside the nozzles and then ejects the burnt cheese into the heating chamber where it mixes with the fresh cheese of the next batch. Any burnt cheese in the kettle tends to taint the remaining cheese with a burnt flavour.

It is known to cook shredded raw cheese in a continuous operation in the manufacture of processed cheese, by passing the raw cheese in a continuous flow through a heat exchanger which is heated by steam. The cheese flows along a cylindrical heating surface on a metal tube which is in contact with steam. It is however necessary to scrape the cheese continuously off the heating surface, usually by rotating blades, since otherwise cheese is burnt onto the heating surface.

The object of the present invention is to provide an improved method and apparatus for heating a granular, communited solid, or viscous product in a continuous operation which avoids the above described disadvantages of heat exchange surfaces.

According to the present invention there is provided a method of heating a granular, communited solid, or viscous product, comprising passing the product continuously through a chamber, injecting steam into a chamber, and mechanically stirring the product in the chamber while the steam is being injected.

In the method of the invention, the heating chamber may be made of a low heat-conducting material, or the chamber may be provided with an internal lining of such material, and the steam injected through openings in the wall of the chamber. There is then little or no risk of the steam heating the wall of the chamber to a temperature which could cause burning of the product. The chamber can however conveniently be made of metal, for example stainless steel, and the steam injected into the chamber through nozzles made of a low heat-conducting material. An example of such material is polytetrafluoroethylene marketed under the Registered Trade Mark Teflon. The ends of the nozzles can conveniently be flush with the inside surface of the chamber, and since the nozzles are of low heat-conducting material there is no risk of the wall of the chamber surrounding the nozzles attaining a high temperature due to conduction.

The heating chamber is preferably elongated and the steam injected into the chamber at spaced intervals along the chamber, so as to heat the product progressively during passage along the chamber. In a preferred embodiment the heating chamber comprises a cylinder having a length which is several multiples of its diameter, and the product is stirred by a rotor having vanes which are spaced close to the inside surface of the cylinder.

The temperature of the product is preferably measured at or adjacent the discharge end of the heating chamber, and the rate of supply of steam into the chamber regulated in accordance with said temperature so as to maintain the temperature of the product at a predetermined value.

Embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic representation of a flow line for the manufacture of processed cheese, which includes a cooker for heating the cheese in accordance with the method of the invention,

Figure 2 is a cross section through the heating tube of the cooker and showing one of the steam injectors in longitudinal section, and

Figure 3 is a cross section of another construction of cooker for heating cheese in accordance with the method of the invention.

In the flow line shown in Fig. 1, the raw cheese for the manufacture of processed cheese is supplied from a source 10 of new natural cheese, a source 11 of semi-matured cheese (for example cheese which has matured for about three months), and a source 12 of fully matured cheese. Cheese from the three sources 10, 11, 12 is fed in any desired proportions to a mincer 13 of any suitable construction which shreds the cheese, and the shredded cheese is then fed to a mixer 14, for example a Z-arm mixer, where the

shredded cheese is mixed with emulsifier, salt, colouring matter, water, and any desired other additives. The shredded cheese and additive mixture is then fed to the cooker 15 where the mixture is heated to a melting temperature of approximately 85 C. The heated cheese is fed selectively to equipment 16 for filling containers, or to a casting extruder 17 or to an individually wrapped slice extruder 18. The output from the extruders 17 and 18 are fed to wrapping equipment 19. The equipment and extruders 16, 17, 18, 19 can be of any suitable conventional construction.

The cooker 15 comprises a heating tube 20 fitted with a plurality of steam injectors 21 at spaced intervals along the tube 20, a manifold 22 for supplying steam to the injectors, a rotor 23 (Fig. 2) rotatably mounted in the heating tube 20 and driven by an electric motor 24, a constant displacement rotary pump 25 (for example a "Mohno" pump) for feeding a continuous supply of cheese mixture to the inlet end 26 of the heating tube, an auger type feeder 27 for feeding the cheese mixture to the pump 25, the feeder 27 and pump 25 being drivably connected to one another, and a variable speed motor 28 for driving the auger feeder 27 and pump 25.

The heating tube 20 comprises a stainless steel cylinder having a length which is several multiples of its diameter, for example the cylinder may have a diameter of 100 mm and a length between 500 mm and 1000 mm. The rotor 23, shown in Fig. 2, extends the full length of the tube 20 and comprises a central shaft 30, three longitudinal vanes 31 arranged at equal distances around the shaft 30 and parallel thereto, and radial vanes 32 extending between each vane 31 and the shaft 30. The vanes 31 are spaced close to the inside surface of the tube 20, and the vanes 32 are offset relative to one another along the shaft.

Each steam injector 21 comprises a tubular metal casing 35 formed in four sections 36, 37, 38, 39 screwed together end to end as shown in Fig. 2, and an end cap 40 screwed onto the outer end of the section 36 which forms one end of the casing, the end cap having a central aperture 41: A tubular insert 42 formed of Teflon has an external annular flange 43 clamped by the end cap 40 against the outer end of the section 36, the insert projecting through the central aperture 41 in the end cap. A valve member 44 also formed of Teflon is axially movable in the section 36, and a valve adjuster 45 is screwed into the section 39 at the other end of the casing, the valve adjuster 45 having a handle 46 and being connected by a rod 47 to the valve member 44. The rod 47 extends through a stuffing box 48 formed by the section 38 of the casing. The section 37 of the casing is formed with a socket 49 for connection to a steam pipe. The outer end of the Teflon tubular insert 41 forms a nozzle 50 for discharge of steam from the interior of the casing 35, and the inner end of the insert 42 forms a valve seat 51 which co-operates with a conical end on the valve member 44 to regular supply of steam to the nozzle 50.

The heating tube 20 is provided with apertures 55 spaced along its length for reception of the nozzles 50 of the steam injectors 21 as a close fit. The end caps 40 on the injectors are welded to the tube 20 with the central aperture 41 in each end cap aligned with one of the apertures 55 in the tube 20. The nozzles are dimensioned so that their outer ends are substantially flush with the inside surface of the tube 20.

In operation, the motors 24, 28 are driven at a constant speed, dry steam is supplied under pressure to the manifold 22, and shredded cheese mixture is supplied to the auger type feeder 27. The pump 25 forces the shredded cheese mixture at a constant rate through the heating tube 20, the steam discharges into the tube 20 from each of the nozzles 50, and the rotor 23 circulates the cheese within the tube so that the cheese is heated progressively as it flows along the tube. Since the nozzles are made of Teflon which has a low heat conductivity, the nozzles and the wall of the tube surrounding the nozzles remain at a temperature appreciably below that of the steam so that there is little or no risk of the cheese being burnt onto the nozzles or onto the wall of the tube. The temperature of the cheese being discharged from the tube 20; usually at approximately 85°C, may be regulated by turning the handles 46 on the steam injectors so as to regulate the rate of supply of steam to the tube. Alternatively the speed of the pump 28 may be adjusted to regulate the rate of flow of the cheese through the tube.

The cooker shown in Fig. 3 comprises a heating tube 60 mounted in an upright position, a hopper 61 positioned directly above the heating tube 60 and having a tapered outlet portion 62 which leads into and is integral with the upper end of the heating tube 60, and a rotor 63 mounted in the heating tube and hopper. The lower end portion of the rotor 63 is similar to the rotor 23 in the embodiment of Figs. 1 and 2 and comprises a central shaft 64 and longitudinal vanes 65 connected to the shaft 64 by radial vanes 66, the vanes 65 being spaced close to the wall of the heating tube 60. The upper end portion of the rotor consists of the shaft 64 fitted with an auger 67 which extends upwards into the tapered outlet portion 62 of the hopper. The upper end of the shaft 64 is mounted in bearings 68 at the top of the hopper, and the lower end of the shaft is mounted in a thrust bearing located on a support block 70. The support block 70 has an annular flange 71 which is clamped against the lower end of the tube 60 by a collar 72 screwed onto the tube

60. The support block 70 has longitudinal bore 73 for passage of the heated cheese. An electric motor 74 is drivably connected to the upper end of the shaft 64 by a belt 75.

The heating tube 60 is fitted with steam injectors 21 identical to the steam injectors 21 in the embodiment of Figs. 1 and 2, the injectors being shown only in diagrammatic form in Fig. 3. The steam injectors are connected to a common manifold 22 supplied with dry steam under pressure from a pipe 76 fitted with a conventional condensate trap 77. As in the embodiment of Figs. 1 and 2, each steam injector has a nozzle formed of Teflon, the outer end of the nozzle being flush with the inside surface of the heating tube 60, and each steam injector has a valve adjustable by a handle 46 for regulating the rate of supply of steam through each nozzle.

In operation, the rotor 63 is driven by the motor 74, steam is supplied to the manifold 22, and shredded cheese mixture is supplied to the hopper 61. The auger 67 feeds the cheese into the tube 60, the steam discharges into the tube 60 from each of the nozzles of the steam injectors, and the auger and rotor circulate the cheese within the tube, as in the embodiment of Figs. 1 and 2.

The lower end of the heating tube 60 is fitted with a temperature probe 78 for measuring the temperature of the cheese being discharged from the lower end of the tube, and the steam pipe 76 is fitted with a valve 79 and control means 80 operable to regulate the quantity of steam supplied to the manifold 22 in accordance with the temperature measured by the probe so as to maintain the temperature of the cheese being discharged from the cooker at a substantially constant value.

CLAIMS

1. A method of heating a granular, comminuted solid, or viscous product, comprising passing the product continuously through a chamber, injecting steam into the chamber, and mechanically stirring the product in the chamber while the steam is being injected.

2. A method as claimed in Claim 1, wherein the steam is injected into the chamber through nozzles formed of material having a low heat conductivity, such as polytetrafluoroethylene.

3. A method as claimed in Claim 2, wherein the ends of the nozzles are substantially flush with the inside surface of the chamber.

4. A method as claimed in any of claims 1–3, wherein the chamber is elongated and the steam is injected at spaced intervals along the chamber, so as to heat the product progressively during passage along the chamber.

5. A method as claimed in Claim 4, wherein the chamber comprises a cylinder having a length which is several multiples of its diameter and the product is mixed by a rotor having vanes spaced close to the inside surface of the cylinder.

6. A method as claimed in Claim 5, wherein the product is fed by a pump to the inlet end of the chamber, the pump generating a pressure in the product sufficient to force the product through the chamber.

7. A method as claimed in Claim 6, wherein the product is fed into the chamber by a constant displacement pump, the speed of which is variable to control the mass rate of flow of the product through the chamber.

8. A method as claimed in Claim 5, wherein the chamber is in an upright position and the product flows through the chamber by gravity.

9. A method as claimed in any of claims 1–8, comprising measuring the temperature of the product at or adjacent the discharge end of the chamber, and regulating the supply of steam to the chamber in accordance with said temperature so as to maintain the temperature substantially at a predetermined value.

10. A method as claimed in any of claims 1–9, in which the product is a shredded cheese mixture and is heated to a temperture sufficient to melt the cheese mixture.

11. A cooker suitable for heating a granular, comminuted solid, or viscous product, in accordance with the method of Claim 1, the cooker comprising a heating tube open at the ends thereof for passage of the product therethrough, means for forcing the product through the heating tube, steam injectors for supplying steam to the interior of the chamber, and a power driven rotor operable to circulate the product within the chamber during passage of the product along the chamber.

12. A cooker as claimed in Claim 11, wherein the steam injectors have nozzles for discharge of steam, and the wall of the heating tube has apertures through which the nozzles extend, the nozzles being formed of material having a low heat conductivity, such as polytetrafluoroethylene.

13. A cooker as claimed in Claim 12, wherein the steam injectors are spaced along the length of the heating tube.

14. A method of heating a granular, comminuted solid, or viscous product, substantially as hereinbefore described with reference to any of the accompanying drawings.

15. A cooker suitable for heating a granular comminuted solid, or viscous product in accordance with the method of Claim 1, substantially as hereinbefore described with reference to Figs. 1 and 2 or Fig. 3 of the accompanying drawings.

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